

Memorandum

Date: August 25, 2000

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CALFED Bay-Delta Program

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Subject: Water Management Strategy Evaluation Framework, Status of Work and Available Data

This memorandum describes work completed on a Water Management Strategy Evaluation Framework by the Water Management Planning Branch during Phase II of the Bay-Delta Program. Our primary purpose in developing an evaluation framework is to provide a comprehensive, systematic approach to study and evaluate alternative water management strategies. Evaluation of alternative water management strategies will be a central part of the Stage 1 actions outlined in CALFED's June 9, 2000, *California's Water Future: A Framework for Action*. In the *Framework*, state and federal policy-makers assert that "The success of all of the [CALFED] elements is dependent upon expanded and more strategically managed storage" and that "Storage projects are not developed in isolation but rather as part of an overall water management strategy." While more work remains to provide improved planning tools to help guide implementation of the Bay-Delta Program, CALFED has made significant progress towards this goal. Moreover, development work conducted over the past year has provided valuable information and insight into the effects of different water management tools and operations on water supply reliability, water quality, and Delta hydrodynamics.

The first step in evaluating alternative water management strategies is identifying relevant performance criteria. CALFED conducted a series of workshops with stakeholders and CALFED member agencies designed to clarify definitions of objectives and compile a list of performance criteria that could be used to evaluate different proposed water management strategies. The results of this effort are described in a draft report entitled *Water Management Strategy Evaluation Framework*, December 1999.

CALFED Agencies

California

- The Resources Agency
- Department of Fish and Game
- Department of Water Resources
- California Environmental Protection Agency
- State Water Resources Control Board
- Department of Food and Agriculture

Federal

- Environmental Protection Agency
- Department of the Interior
- Fish and Wildlife Service
- Bureau of Reclamation
- U.S. Geological Survey
- Bureau of Land Management
- U.S. Army Corps of Engineers

- Department of Agriculture
- Natural Resources Conservation Service
- U.S. Forest Service
- Department of Commerce
- National Marine Fisheries Service
- Western Area Power Administration



This exercise identified a list of tangible criteria that can be used to compare performance of different water management strategies. These criteria include items at different locations in the system such as salinity, amount of water delivered, frequency of shortage, cost to implement, and stream temperature. These criteria can be measured over time and some can be predicted using models.

To evaluate how each proposed water management strategy will perform, changes in performance due to operational and / or structural changes contained in the proposed water management strategy must be estimated. Estimating changes in performance is most often done using computerized simulation models. CALFED has been working for several years to improve the existing capability for estimating resulting changes in water allocation, delivery reliability, urban economic impacts, agricultural economics, groundwater levels and environmental performance. Estimating all of these different elements requires the use of several simulation models. Unfortunately, these models were not designed to work together originally, but rather were developed independently over many years to answer different questions.

Description of Work

CALFED has been working to adapt and apply existing simulation models (such as DWRSIM, DSM2, CVGSM, LCPSIM and CVPM) to provide comprehensive predictions of performance for alternative water management strategies that include structural and operational changes. While developing this capability, CALFED formulated a small set of water management alternatives that emphasized different water management objectives, such as improved water supply reliability, improved water quality, and improved operational flexibility for Delta fisheries, to demonstrate how this approach could be used. These alternatives were formulated to represent demands and hydrology expected in 2020 with different assumptions about additional surface and groundwater storage, as well as how the new facilities would be operated. By simulating these different assumptions about system operations, resulting conditions can be predicted and quantified according to defined performance criteria and compared to other proposed water management strategies. (See Appendix A for a summary of the example alternatives.)

One of the biggest challenges of adapting the existing models to evaluate proposed water management strategies has been sharing data between the different simulation models. Each of the models was developed independently and uses different formats for data input and output. Each of the models also contains various assumptions and these assumptions must be made consistent between the models if they are used together. The existing models and their assumptions have been reviewed and custom pre- and post-processing software has been developed to help share information between the models to accomplish comprehensive analyses necessary to evaluate and compare potential CALFED water management strategies.

The example water management strategy alternatives have been modeled successfully to predict water system operations, water deliveries, impacts to urban economics and changes in Delta water quality. Work is ongoing to predict changes in agricultural

economic performance and groundwater levels. The model results are contained in the computer files listed in Appendix B.

Sample Results

This section contains some examples of the types of results that can be produced using this approach. Figure 1 is an example of how total bay-delta deliveries are expected to differ for resource mix B operated for different priorities (supply vs. quality and different levels of delta pumping curtailment). Figure 2 illustrates economic changes in South Coast regional costs for resource mixes A, B, and C operated to improve supply at three different pumping curtailment schedules.

Figure 1: Example Tradeoff of Total Bay Delta Deliveries

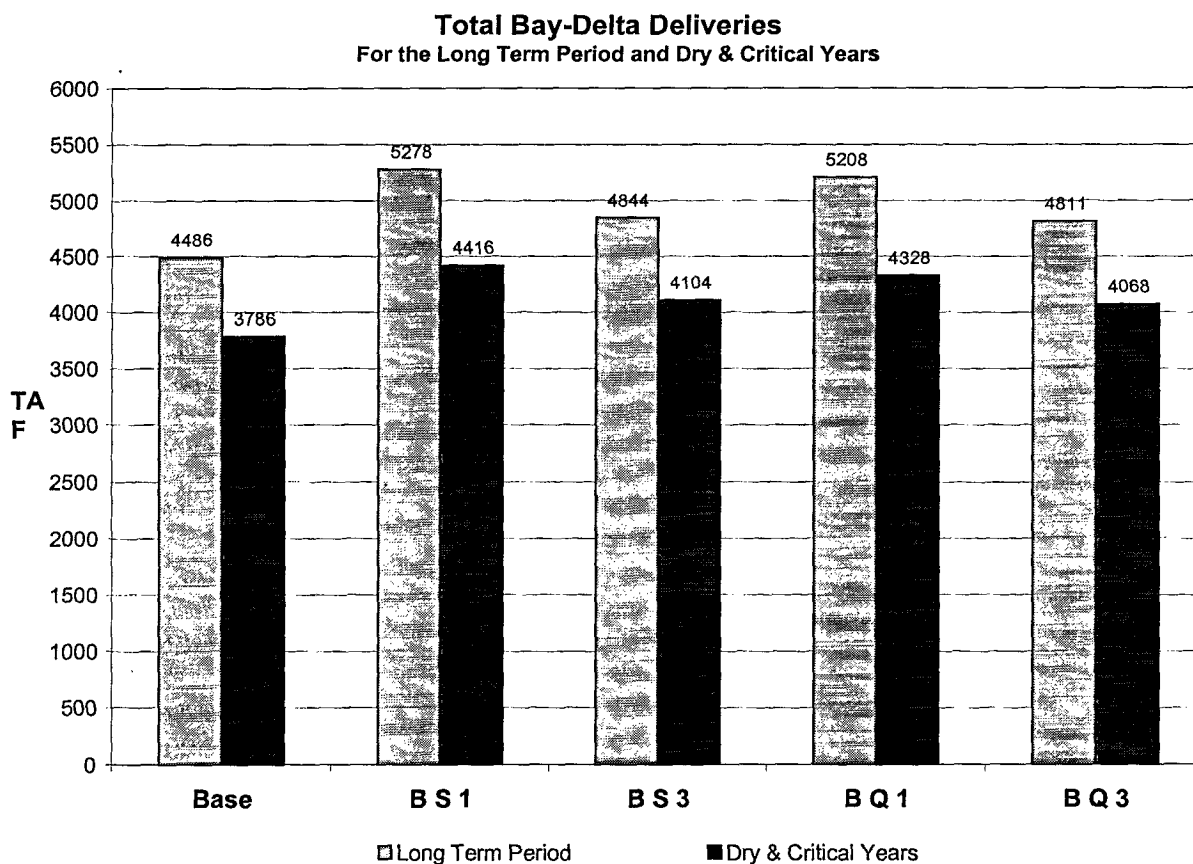
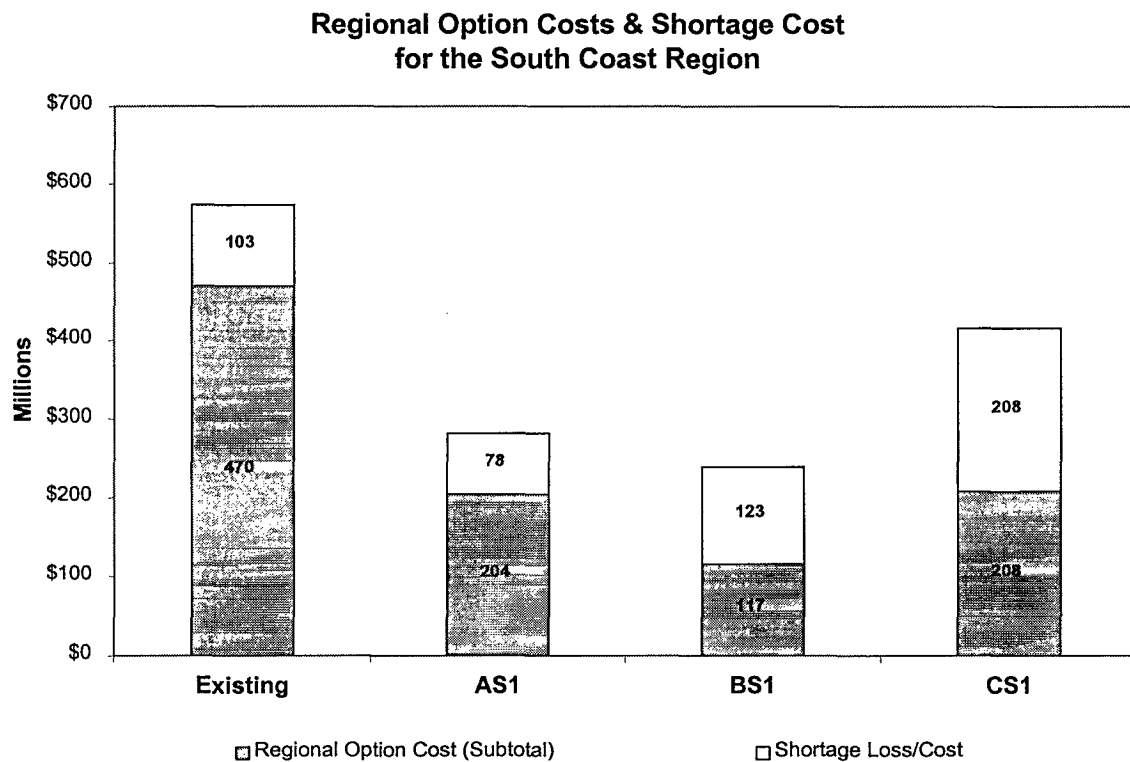


Figure 2: Example Tradeoff of Regional Urban Costs for Different Resource Mixes



Future Work

CALFED is continuing to improve data management and modeling capability to help evaluate potential water management strategy alternatives. Efforts are underway to replace the use of DWRSIM with the new systems simulation model CALSIM to take advantage of the additional flexibility offered by CALSIM. Methods and software needed to share data between different simulation models is also being evaluated and improved. A systematic review of data collection, management and distribution techniques has begun to help make monitoring data collected during Stage 1 as useful as possible.

Appendix A. Description of Example Water Management Strategy Alternatives

The purpose of evaluating a set of hypothetical alternatives is to test a variety of alternative long-term water management strategies (WMS) in the context of specific objectives. The alternative strategies reflect emphasis on a variety of water management tools. The comprehensive evaluation includes hydrologic and economic analyses and assessment of environmental and social impacts. The predicted performances of alternative strategies are evaluated according to a clearly defined set of performance measures. A systematic presentation of performance measures can help characterize tradeoffs between objectives under different system management options.

Approach

The first set of example WMS alternatives includes a broad variety of assumptions and provides the basis for further analysis. The assumptions used in this first set are based on stakeholder preference sets developed through the Economic Evaluation of Water Management Alternatives Screening Analysis. Information developed through hydrologic and economic studies conducted over the past year (WMS support studies) also were used to set specific detailed assumptions.

Assumptions

As a beginning, three different resource mixes were formulated. These alternative system configurations are distinguished by differences in surface and groundwater storage facilities, maximum SWP deliveries, amounts of allowable fallowing for transfers, and methods for allocating new water supplies. To help characterize system flexibility and ability to meet EWA objectives, each of the three resource mixes are subjected to three different levels of delta export curtailments. Water supply reliability will be maximized under each of these conditions. In addition, operations for the three resource mixes are conducted to improve Delta drinking water quality to the extent possible (using the lowest level of export curtailments) while maintaining a base level of water supply reliability.

Table A-1: Basic Resource Mix Summary

Resource Mix	Emphasis
A	Exports restricted to 1995 levels, no new surface storage
B	New surface storage with supply benefits allocated to urban water users
C	New surface storage with supply benefits split between urban and agricultural water users

Common Elements

Each of the alternatives evaluated contain some common elements as listed below:

- All 2020 upstream of Delta and in-Delta water supply needs are fully accounted for in all alternatives
- All alternatives include full implementation of conservation Best Management Practices (BMPs)
- The conservation component of new local supply development is comprised of measures that go beyond BMPs
- Each alternative meets current and expected regulatory requirements and ERP flow targets (as typically simplified for use with DWRSIM -- a system operations model that operates on a monthly time step)
 - Delta Standards
 - May 1995 WQCP
 - CVPIA (b)(2)
 - 367-815 TAF Trinity In-stream Requirement
 - Up to 48 days of Discretionary Pumping Curtailment
- Each alternative includes conjunctive use projects north and south of the Delta
- Each alternative relies on water acquisitions for the environment and agricultural to urban transfers
- Urban water users' future needs are met through a combination of Bay-Delta deliveries, water transfers, and local supply options
- Each alternative is expected to provide increased supply during dry and critical years
- Water quality modeling focuses on salinity not TOCs
- When operated for supply, all alternatives meet Delta salinity standards
- Additional facilities can be used to improve water quality beyond existing standards
- When operated for quality, alternatives reduce TDS in the Delta by up to nearly 25%

Key Differences

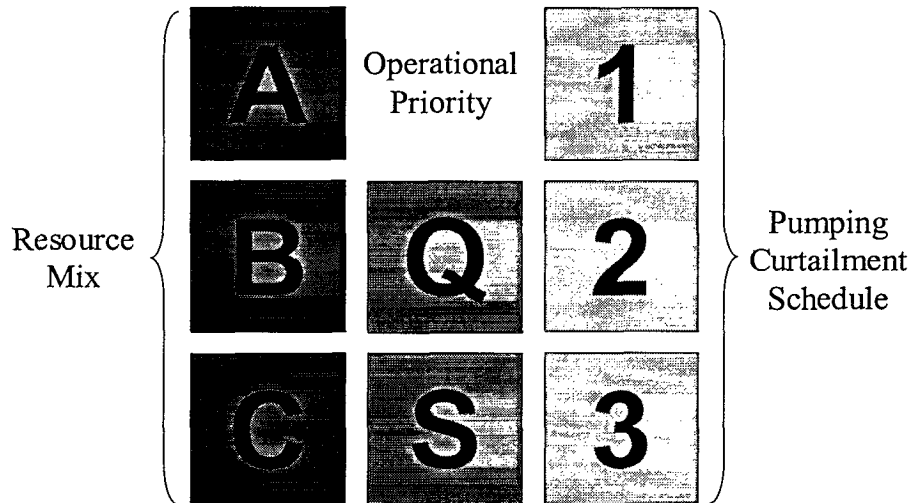
- Resource mixes B and C include additional surface storage at Shasta and Sites
- Resource mix A limits total exports to 1995 levels
- Resource mixes A and B allocate all of the supply benefits of new facilities to urban users first
- Resource mix C allocates supply benefits in the same proportions as existing supplies are allocated

Nomenclature for Water Management Strategy Alternatives

The example water management strategy alternatives being evaluated are different combinations of resource mixes, operational priority, and pumping curtailments (See Figure A-1). For example, alternative AQ1 is an alternative that has no new surface

storage (resource mix A), operated to improve water quality in the delta and providing a modest increase in pumping curtailments for the benefit of delta fisheries.

Figure A-1: Key to Alternatives



Appendix B. Computer Simulation Results Files for Example Water Management Strategy Alternatives

Results from the example Water Management Strategy Alternatives described in Appendix A are contained in electronic files stored on CALFED and DWR computer systems. Alternative Studies may be found in the following Network Directory Structure:

DWRSIM: Mod_d1 on 'aztlan' \tools\mark\sim_studies\Wms DSS Files

DSM2: /delta2/CALFED-dec99requests

Results are available for the following alternative studies:

Study	DWRSIM System Operations Model	DSM2 Delta Simulation Model
BASE	X	X
A_S_1	X	X
A_S_2	X	X
A_S_3	X	X
A_Q_1	X	X
A_Q_3	X	X
B_S_1	X	X
B_S_2	X	X
B_S_3	X	X
B_Q_1	X	X
B_Q_3	X	X
B_S_1_nss	X	
B_S_2_nss	X	
B_S_3_nss	X	
B_Q_1_nss	X	
B_Q_3_nss	X	
C_S_1	X	X
C_S_1_20	X	X
C_S_2	X	X
C_S_3	X	X
C_Q_1	X	
C_Q_3	X	
C_S_1_nss	X	
C_S_2_nss	X	
C_S_3_nss	X	
C_Q_1_nss	X	
C_Q_3_nss	X	

Notes:

- _nss denotes no new surface storage included in facility mix for this alternative study.
- _20 denotes increased instream flow requirements for Sacramento River offstream storage operation.